

NHDOT SPR2 PROGRAM

RESEARCH PROGRESS REPORT

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a progress report at least every three months during the project duration. Reports are due the 5th of the month following the end of the quarter. Please provide a project update even if no work was done during this reporting period.

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project # 26962N | | Report Period Year: 2017 <input type="checkbox"/> Q1 (Jan-Mar) <input checked="" type="checkbox"/> Q2 (Apr-Jun) <input type="checkbox"/> Q3 (Jul-Sep) <input type="checkbox"/> Q4 (Oct-Dec) |
| Project Title: Layer Coefficients for NHDOT Pavement Design | | |
| Project Investigator: Eshan Dave and Jo Sias Daniel Phone: 603-862-5268, 603-862-3277 E-mail: eshan.dave@unh.edu , jo.daniel@unh.edu | | |
| Research Start Date: December 1, 2016 | Research End Date: September 30, 2018 | Project schedule status: <input checked="" type="checkbox"/> On schedule <input type="checkbox"/> Ahead of schedule <input type="checkbox"/> Behind schedule |

Brief Project Description:

At present, New Hampshire Department of Transportation (NHDOT) employs AASHTO Empirical Pavement Design procedure for structural design of highways (new construction, reconstruction and major rehabilitations). The AASHTO procedures uses material specific coefficients (commonly called layer coefficients) to account for the structural capacity provide by each pavement layer. The current layer coefficients used by NHDOT are a combination of the original values proposed by AASHTO in 1960s and research conducted by Janoo in 1994 (CRREL Special Report 94-30). The research by Janoo was primarily focused on layer coefficient characterization of subgrade soils and aggregate courses. The asphalt mixtures in use today and vehicle loadings are substantially different from the ones characterized by AASHTO during the development of the design guide in 1960s. With current use of newer asphalt binder modification technologies, allowance for recycled materials (RAP, ground tire rubber), and newer manufacturing and construction techniques (such as, cold in-place recycling) there is an urgent need to reevaluate the layer coefficients for materials that are currently being used in construction of State pavements. Due to lack of reliable layer coefficient values, there is high potential for over-design of pavements that translate in substantially higher spending. In order to promote sustainability and to maintain integrity through reliable pavement designs, this research study will characterize asphalt mixtures currently used by State for determination of the actual layer coefficient values for those materials.

Progress this Quarter (include meetings, installations, equipment purchases, significant progress, etc.):

- The project meeting between researchers and technical advisory group (TAG) was held during this past quarter in Concord NH. The objectives of the meeting were the progress of the project, additional mix sampling for the project and the necessity of PMS data for analysis and validation of layer coefficients derived from laboratory tests.
- The literature review which was conducted during the last quarterly is prepared in the form of a report. Draft version of this literature review is provided in the appendix.
- Establishment of the bulk and maximum specific gravity for the recently sampled mixed (T-3) was done and gyratory samples for Complex and resilient modulus testing were fabricated for this mix. Complex modulus testing is being performed on the 9 available mixtures. Resilient modulus testing was conducted successfully in the lab on trial samples and a MATLAB code was written in accordance to the ASTM standard to run the analysis and calculations. The results and output file from MTS and the associated analysis are under verification through comparison to the output files, results and analysis that have been collected from the Texas A&M University.
- Specimen fabrication for other performance testing on the mixtures sampled through this study also begun in the past quarter. Other performance tests include semi-circular bend and disk-shaped fracture energy tests as well as simplified viscoelastic continuum damage (S-VECD) fatigue characterization.

Items needed from NHDOT (i.e., Concurrence, Sub-contract, Assignments, Samples, Testing, etc.):

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- As per the discussions during the kick-off meeting and follow up meeting in May 2017, researchers will work together with NHDOT staff to obtain access to the PMS data.
- Sampling effort for the remaining mixtures need to be continued by NHDOT for the 2017 construction season.

Anticipated research next 3 months:

- Laboratory Evaluation: Researchers anticipate completion of the resilient and complex modulus testing for the nine mixtures that have already been sampled in 2016 and 2017.
- Analysis: Results from the laboratory testing effort will be analyzed during the upcoming quarter. Researchers will also work with NHDOT staff to identify past projects that utilized mixtures similar to the ones studied herein so that PMS data for those pavements can be obtained.
- Reporting: The completed analysis of complex and resilient modulus along with the preliminary layer coefficients of the available mixtures will be reported.

Circumstances affecting project: Describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope, and budget, along with recommended solutions to those problems.

| Tasks (from Work Plan) | Planned % Complete | Actual % Complete |
|------------------------------------|--------------------|-------------------|
| Literature Review and Testing Plan | 100 | 100 |
| Laboratory Characterization | 30 | 20* |
| Development of Layer Coefficient | 0 | 0 |
| Reporting | 0 | 0 |

* Resilient modulus testing was anticipated to be conducted for the 8 available mixtures in the past quarter. However, researchers want to ensure that necessary verification of the test results and analysis for higher accuracy was the reason for not running this test on the actual samples.